

Cost-Effective Innovative Personal Protective Equipment for the Management of COVID-19 Patients

Sir,

Intubating a patient infected with COVID-19 increases the risk of disease transmission to healthcare workers (HCWs) as it is an aerosol-generating procedure.^[1] As the pandemic accelerates, access to personal protective equipment (PPE) for HCWs is a key concern. PPE shortages have been described in most affected countries.^[2] During such PPE shortage times, CDC as well as WHO emphasise on the innovative strategies so that the available supplies can be extended till the most critical needs.^[3,4] The world needs new innovations which can minimize the use of PPE (coverall, N95 masks, goggles, etc.).

PIPE-FRAMED HEAD HOOD

Polyvinyl chloride (PVC) pipes were attached to two different planes to form a box-like structural framework. It was covered by plastic sheets from all sides. Two holes were made on the one side of the hood for inserting hands from the head-end of the patient during intubation [Figure 1]. The two holes were covered with a flexible elastic material to allow sufficient hand movements and good hand seal. The plastic cover at the caudal end of the hood was left to hang as a curtain so that the assistant can provide intubating equipment by adjusting the curtain. Intubation was practiced using the pipe-framed head hood initially on airway mannequins followed by cadavers. This head hood was very feasible to use and could effectively control the airborne spread of COVID-19 to HCWs during endotracheal intubation. Further, this head hood is less expensive as it costs 500 Indian rupees per hood (6.5 \$).

PATIENT COVERALL

We made a patient coverall which will cover the patient from head to toe so that such patients can be easily transferred in between wards without the fear of aerosol and droplet transmission [Figure 2]. The basic framework was made using PVC pipes along different planes over which plastic sheets were placed to cover all around. This coverall may also be used in the intensive care units to minimize the contact with COVID patients. The total cost for making this patient coverall was 800 Indian Rupees (10.5 \$).

COVID-19 HUMAN BIOSAFETY CABINET

This cabinet was made of PVC cardboard with a transparent glass on the front side fitted with a pair of rubber gloves [Figure 3]. The cabinet was utilized to perform oropharyngeal/nasopharyngeal swab sampling of suspected COVID-19 patients. The patient was asked to sit inside the cabinet, and the sample was taken from outside via the rubber gloves attached to the glass. For each patient, a pair of surgical gloves were worn over the rubber gloves and then removed once the sampling was done. After the

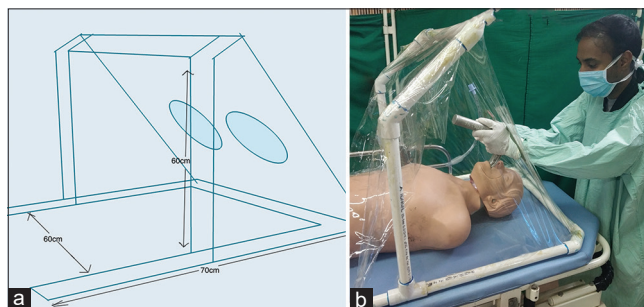


Figure 1: (a) Schematic diagram of pipe-framed head hood, (b) pipe-framed head hood used for endotracheal intubation



Figure 2: (a) Schematic diagram of pipe-framed patient coverall, (b) pipe-framed patient coverall used for patient shifting

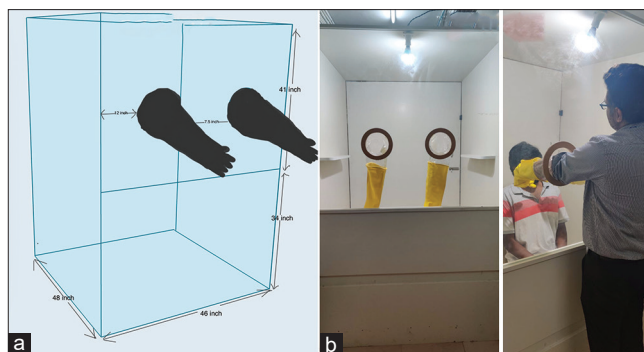


Figure 3: (a) Schematic diagram of COVID-19 human biosafety cabinet, (b) COVID-19 human biosafety cabinet used for collecting samples

sampling procedure, thorough disinfection of the cabinet was done using 0.5% sodium hypochlorite solution. This cabinet minimizes direct contact with the patient and aerosol transmission to HCW during sampling and also negates the use of PPE.

We propose our innovations to be used as extended PPE so that we can minimize the routine PPE usage during these pandemic.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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